have indicated that fish in the wild live for approximately 1 year after developing the first tumors. When these fish are transferred to the laboratory, their rate of tumor development slows considerably. Although tumor remission has never been observed, these diseased fish may live for several years in the laboratory, suggesting that the rate of progression of DNF is affected by environmental factors.

Despite the large number of studies of carcinogenesis in fishes, few have investigated immune system responses at any level. The immunology of DNF is being examined in collaboration with another center investigator, Churchill McKinney of the Department of Microbiology and Immunology of the University of Miami School of Medicine. Immune responses in damselfish are being investigated from three perspectives: 1) the effects of the disease process on the various components of the immune response, 2) anti-tumor activity of leukocytes in these fish, and 3) the type, distribution, and function of tumor-infiltrating leukocytes in DNF. The first group of studies has demonstrated that damselfish in advanced stages of DNF are often severely immunosuppressed relative to healthy individuals. Tumor-bearing, but not normal fish, have cells capable of killing tumor targets. These cytotoxic responses have both nonspecific and specific components, indicating that at least two populations of cytotoxic cells are present. Finally, histological studies have shown that neurofibromas in DNF are characterized by a conspicuous granulocytic infiltrate, as are neurofibromas in NF1. In humans these cells are basophilic mast cells, whereas in damselfish they are eosinophilic granule-containing cells (EGCs). The density of EGCs in tumors depends on the nature of the inoculum used to induce the tumors. Ongoing studies are focusing on the identity and control of the cytotoxic cells evoked in DNF and the role of the EGCs in tumorigenesis.

Subtropical and Tropical Bioindicators

Numerous studies of marine and estuarine animals in temperate, heavily polluted environments have demonstrated that pollution can have severe effects on the health of the resident fauna. Researchers have developed bioindicators of stress for different species in different habitats. The usefulness of these indicators in subtropical or tropical environments, especially those that are not severely polluted, has not been adequately investigated. Biscayne Bay is a shallow estuarine/marine bay adjacent to Miami. The sediments in some areas of the bay are moderately polluted with petroleum hydrocarbons and heavy metals. UM center scientists have conducted a survey of fish health in Biscayne Bay. The study revealed that up to 11% of fish in four target species (sea bream, blue-striped grunt, pinfish, and grey snapper) exhibit some type of morphological abnormality. The most common types of abnormalities were deformation or loss of spines of the dorsal fin or disorientation of patches of scales. Significant differences were found in the prevalence of these abnormalities between different collection sites in the bay. Ongoing studies are aimed at identifying environmental factors associated with high prevalences of these abnormalities. Correlations between the prevalence of abnormalities and distribution of contaminants in sediments are being investigated further via laboratory exposures. In addition, the usefulness of a number of physiological measures as bioindicators are being evaluated in different species under a variety of environmental conditions in the laboratory and the field. Levels of phase I and II detoxification enzymes, lipid peroxidase, metallothioneins, heavy metal concentrations, phagocytic activity of macrophages, and levels of heat-shock proteins have been monitored.

Timing Is Everything in New Breast Cancer Studies

The timing of exposures to environmental agents during critical developmental periods as it pertains to risk of abnormal development and breast cancer is the focus of recently funded grants from NIEHS. The grants were made in response to applications received through a grants Request for Applications (RFA ES 94-004). The RFA also focused on studies to understand the cellular, genetic, and hormonal effects of environmental agents on the normal growth and development of the mammary gland and to study the role of environmental factors on the development of breast cancer. The grants also intend to further understanding of the mechanism of action of environmental exposures to agents such as organochlorine pesticides, polyaromatic hydrocarbons, and radiation in the development of breast cancer.

The six grantees, their affiliations, and the titles of their proposed studies are:

- Scott Burchiel, University of New Mexico: Mammary Cell Signaling Produced by Environmental Agents;
- Chia-Cheng Chang, Michigan State University: Mechanisms of Environmental Agent-induced Breast Cancer;
- Colin Jefcoate, University of Wisconsin: Organochlorine Compounds and Human Breast Cytochrome P450;
- Coral Lamartiniere, Louisiana State University: Timing of Environmental Chemicals in Breast Cancer;
- Robert Liburdy, Lawrence Berkeley Laboratories: Environmental Magnetic Fields and Human Breast Cancer;
- Jose Russo, Fox Chase Cancer Center: Susceptibility of the Breast to Environmental Carcinogens.

NIEHS, NCI, and NIA Colaborate on Breast Cancer

NIEHS is collaborating with the National Cancer Institute and the National Institute on Aging in funding four developmental center grants at NCI-designated Cancer Centers to initiate research programs to focus on the role of environment in breast cancer. All three institutes are constituents of the National Institutes of Health. This funding allows faculty of the medical schools associated with the Cancer Centers to hold meetings and retreats to develop plans for major research programs on the relationship between environmental agents and breast cancer.

New faculty will be recruited and pilot studies will begin to gather the important data necessary to successfully compete for research funding. The centers are funded so that they may use a multidisciplinary approach in exploring the etiology of breast cancer, drawing on the expertise of basic scientists, clinicians, and epidemiologists. The awards went to Karen Antman of Columbia University, Nancy Davidson of Johns Hopkins University, Ronald Herberman of the University of Pittsburgh, and J. Dirk Inglehart of Duke University.

Center Director Named AAAS Fellow

Daniel W. Nebert, Director of the Center for Environmental Genetics at University of Cincinnati Medical Center, and Director of the NIEHS Environmental Health Sciences Center in Cincinnati, has been elected a fellow of the American Association for the Advancement of Science by the AAAS Council. Each year, beginning in 1874, the council elects members whose contributions to science are distinguished. Nebert was cited particularly for "many contributions to the fields of pharmacogenetics, the cytochrome P450 gene nomenclature system, evolution of drug metabolizing enzymes, carcinogenesis, and environmental toxicology." Nebert's election to this distinguished fellowship was acknowledged by presentation of a certificate and rosette at the AAAS Fellows Forum, February 18, a part of the association's 1995 annual meeting in Atlanta, Georgia.